SPATIAL AND SEASONAL DISTRIBUTION OF *PETROCHIRUS DIOGENES* (ANOMURA, DIOGENIDAE) IN THE UBATUBA BAY, SÃO PAULO, BRAZIL

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ABSTRACT

The influence of some abiotics factors in the seasonal and spatial distribution of *Petrochirus diogenes* (Linnaeus, 1758) in the Ubatuba Bay, São Paulo, Brazil was studied. The hermit crabs were monthly collected, throughout September 1995 to August 1996. Each collection comprised eight transects, composed of three repetitions which were made in three serial days. It was obtained 130 individuals of *P. diogenes*, distributed mainly in three transects (IV, V and VI), with a larger incidence in autumn and winter. The individuals' association with the abiotic factors revealed that its distribution is mainly related with the presence of high percentage of organic matter and coarse sediments. The occurrence and distribution of *P. diogenes* are influenced not only by favorable abiotic factor, but also depend of a group of biotic factors like availability of gastropod shells.

KEYWORDS. Hermit crab, distribution, *Petrochirus diogenes*, Anomura, Brazil.

INTRODUCTION

The ocean resources still stay poorly investigated in spite of what it can offer for the humanity. Thus, studies in restricted areas near the coast as bays and estuaries can supply basic knowledge of antropic or natural influency in these sites. Such areas, can gather great conditions for the establishment of several species of commercial or even of ecological interest as in the trophic chain.

The temperature, salinity, texture of the sediment and organic matter content present in certain locals, should be considered in the bioecological studies on benthonic life. This assertion is due to fact that they control the productivity of the sea and they determine peculiar environmental situations, which could favor or not the presence of certain species (Abele, 1974; Buchanan & Stoner, 1988; González-Gurriarán **et al.**, 1991).

Few studies were accomplished about the spatial distribution of Paguridea and its relationship with the environmental factors. Rebach (1974) analyzed the preference of

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Pagurus longicarpus Say, 1817 by different substratum types during its migration of the estuary to deeper waters in the winter and LOWERY & NELSON (1988) investigated the patterns of spatial distribution of *Clibanarius vittatus* (Bosc, 1802) in relation to the bottom type.

For the Ubatuba area investigations related to distribution and faunistic composition of Anomura were accomplished by HEBLING **et al.** (1994) and NEGREIROS-FRANSOZO **et al.** (1997).

The aim was to study the spatial and seasonal distribution of *Petrochirus diogenes* (Linnaeus, 1758) at the Ubatuba Bay in function of some environmental factors.

MATERIAL AND METHODS

The individuals of *P. diogenes* were collected by trawl in the Ubatuba Bay, Ubatuba, São Paulo, Brazil, with a commercial fishing boat equipped with two double-rig nets. The body net has a 12 mm mesh and the cod end, 10 mm.

The collections were monthly accomplished throughout year from September 1995 to August 1996, comprising eight transects of 1 km of extension, made in three serial days (fig. 1). The hermit crabs were stored in plastic sacks, labeled and conditioned in thermal boxes with pricked ice. In the laboratory the specimens were counted to establish the number of individuals collect by transect, dissected and discharged.

In the medium point of each transect (= station) samples of the substratum and water from the bottom were collected for analysis of the environmental factors. Water was collected with a van Dorn bottle in order to obtain the temperature and the salinity. Sediment was sampled with a catcher of van Veen. The American scale was used (WENTWORTH, 1922) to determine the pattern of texture of the sediment, soon after the measures of central tendency (MCT) were calculated (SUGUIO, 1973). The amount of organic matter was obtained by means of the weight free from the ashes, expressed in percentage. The depth was obtained by direct survey. More details on the methodology and statistical similarities in relation to the environmental factors can be found in MANTELATTO & FRANSOZO (1999), who studied the physical and chemical parameters in the Ubatuba Bay.

The variation of the abiotic factors were tested by analysis of variance, complemented by Tukey test ($p<0.05$) (SOKAL & ROHLF, 1979).

The data of the abiotic factors were tested against the presence of *P. diogenes* in the transects sampled. Such relationships consisted of distributing the obtained total results of these factors in classes, determining the number of captured specimens and the frequency of repetitions of the values for each class of the factors, with the obtaining of the individuals' relative frequency by collection. The similarities among classes of abiotic factors were tested by Kruskal-Wallis (SOKAL & ROHLF, 1979).

RESULTS

A total of 36 collections were accomplished in each transect, which means 288 trawls at all, being obtained 130 individuals of *P. diogenes*. The specimens were captured with larger frequency in transects IV (43.5%), V (23.7%) and VI (28.2%), where they were found the largest values of organic matter (fig. 2) and coarse sediments (fig. 3). The sum of the other transects, except for II in which no animal was collected, presented 4.6% of occurrence.

A higher incidence of *P. diogenes* individuals was verified in autumn and winter, with 22.9% and 44.3%, respectively, of all collected individuals (fig. 4).

The association of *P. diogenes* with classes of environmental factors of the Ubatuba Bay, being obtained significant differences to depth, organic matter and texture of sediment (MCT). The first temperature class (17–] 20°C) in spite of not presenting significant differences as others, presented larger frequency of captured individuals (fig. 5).

DISCUSSION

Spatial distribution of *P. diogenes* in the Ubatuba Bay was almost restricted to transects IV, V and VI, suggesting these places are different from others, mainly in relation to granulometric fractions and the amount of organic matter.

Diversity of the macrobenthic organisms is strongly related to the complexity of the micro-habitats, which are associated with the characteristics of the substratum (Robert, 1979). Organic matter can be deposited among particles of sediment or accumulated on it, constituing food source for benthic organisms (epifaunal, infaunal and interstitial) including detritivorous crustaceans, which can be utilized as food source by predators.

According to Hazlett (1981), the hermit crabs are great detritivorous and opportunistic feeders. *Petrochirus diogenes* is considered an active predator (Caine, 1975) and its presence in transects with high value of organic matter (IV, V and VI) might means that such sites can offer better alimentary resources than others studied herein.

Negreiros-Fransozo **et al.** (1997) found only five individuals of *P. diogenes* in the Fortaleza Bay, distributed in three of seven sampled transects. Such sites are characterized by the largest values of organic matter found in the Fortaleza Bay, in spite of the predominant sediment to be very fine sand. Perhaps the predominancy of finer sediments and a low content of organic matter in that bay, due to smaller number of individuals collected, when compared with the Ubatuba Bay.

The presence of some species and, possibly, of associations might not be only determined by environmental factors, but biological factors which act indirectly, as

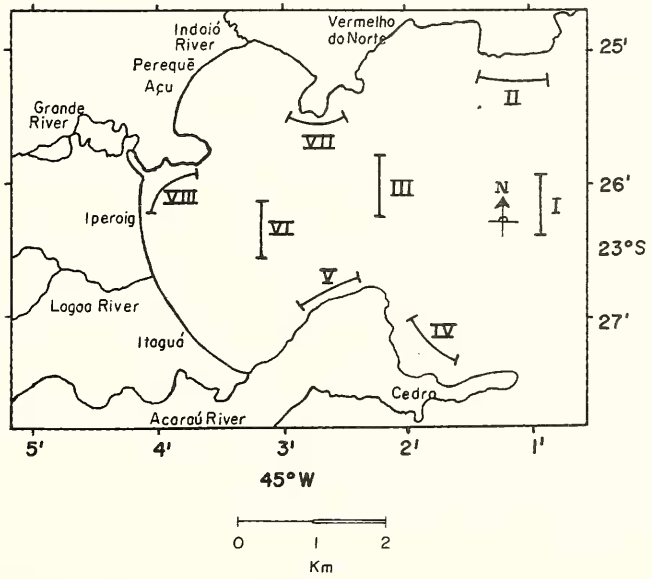
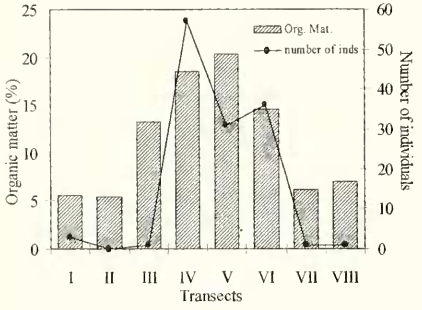


Fig. 1. The Ubatuba Bay, São Paulo, with the indications of the transects.

alimentary competition, relationship predador-prey, reproductive ability, larval development (NEGREIROS-FRANSOZO & FRANSOZO, 1995).

According to MANTELATTO **et al.** (1995) rarely a species is homogeneously distributed in its occurrence area, because it can occur displacements according to the environmental conditions or even due to different demands, during several life phases. Temperature is one of the most important factors among those that act in the distribution of marine species in great latitudinal widths, as it was observed in the studies of BALECH (1951) and TAISSOUM (1973). As the present paper was accomplished in a restricted area, where temperatures not varied too much among transects, in a same collection, it is believed that this factor would not be decisive to spatial distribution of the organisms in the Ubatuba Bay. Even so, it can influence the abundance of those organisms due to seasonal variations.



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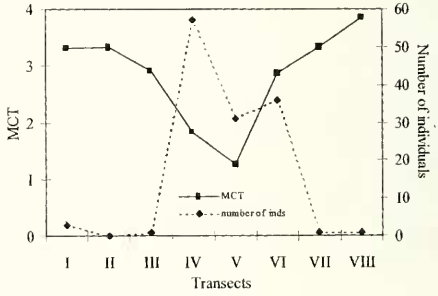

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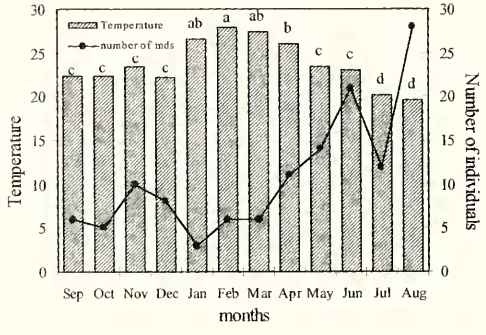

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Figs. 2-4. Absolute abundance of *Petrochirus diogenes*: 2, mean value of organic matter content in the sediment for each sampled transects in the Ubatuba Bay; 3, granulometric composition of sediment, represented by the measure of central tendency (MCT) for each sampled transect; 4, total number of individuals and mean temperature along sampled months. (The bars with at least one same letter did not differ statistically, $p < 0.05$).

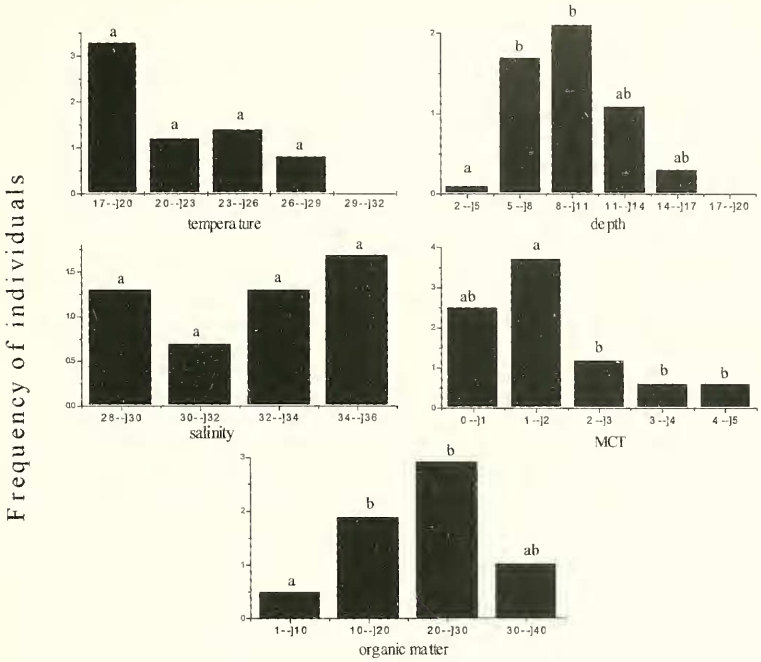

Fig. 5. Frequency distribution of *Petrochirus diogenes* in each abiotic factor classes obtained during September 1995 to August 1996. (The bars with at least one same letter did not differ statistically, $p< 0.05$) (MCT - measure of central tendency).

When the seasonal distribution of *P. diogenes* is analyzed, it is noticed that more than 60% of the individuals were collected in the colds months of the year. This can be verified also for individuals' association with temperature classes, because there was a predominancy in the first class (17 to 20°C). These results corroborate with that obtained by Hebling **et al.** (1994) in the Anchieta Island and Negreiros-Fransozo **et al.** (1997) in the Fortaleza Bay, where *P. diogenes* was captured predominantly in autumn and winter. In that contributions, the number of individuals were very lower to that found in the present study, what can be due to smaller capture effort established.

When it is considered the results of the individuals' distribution in relation to the classes of abiotic factors, it can be pointed out that all factors together will determine the distributional pattern of this species. This fact was also verified for *Hepatus pudibundus* (Herbst, 1758) by Mantelatto **et al.** (1995) and for *Dardanus insignis* (Saussure, 1858) by Fernandes-Góes (1997).

A biotic factor of great importance in the hermit crabs distribution is the presence of gastropod empty shells in appropriate sizes. Those mollusks prefer coarse sediments (Pires, 1992) and its presence attracts the pagurideans, due to possibility of the encounter of empty shells. Analysis of these data, suggest that occurrence and distribution of *P. diogenes* depends not only of favorable environmental factors, but also of biotic factors and, among them, availability of gastropod shells. It can be pointed out, that several

conjugated factors, so much abiotics as biotics can be influencing the distributional pattern of *P. diogenes*. Thus, the Ubatuba Bay, can be considered a favorable place to development and establishment of this species, when compared with other neighbouring bays.

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